PATENT SPECIFICATION

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Int. Cl.:—B 01 d // F03c.

COMPLETE SPECIFICATION

DRAWINGS ATTACHED

A Pumping and Separating Apparatus

I, EUGEN SOEDING, of Schlossgarten 66, Hamburg, Germany, of German Nationality, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to a pumping and separating apparatus including an eccentric screw pump.

An eccentric screw pump contains a rotor, which is helical and has a circular cross-section, and a stator in which a likewise helical cavity is formed. The pitch of the stator is twice that of the rotor. The rotor usually consists of a rigid material, e.g. steel, whereas the stator predominantly consists of an elastic material, e.g. a synthetic-elastomer. By the superimposition of the different pitches of the rotor and stator, closed cavities are produced which progress axially as the rotor rotates. The suction and displacement effect which is produced in this way causes a continuous stream of the medium to be conveyed. As well as its rotational movement, the rotor executes a radial oscillating movement.

An eccentric screw pump is especially suitable for conveying thixotropic, non-flowable, highly pasty and highly viscous media and in fact possibly dry media, even when these are substantially non-homogeneous.

According to the present invention there is provided a pumping and separating apparatus, comprising an eccentric screw pump for pumping a liquid-solid mixture, a chamber arranged at the pressure side of said pump and having an outlet for solids which is disposed on the axis of said pump at an end of said chamber remote from said pump and also having a tubular wall encircling said axis through at least part of which wall liquid can pass such that said wall serves to separate liquid out of said mixture, and a discharge screw arranged within said chamber and coupled to the screw of said pump for forwarding solids of said mixture towards said outlet.

Advantageously, the tubular wall, or that part of the tubular wall through which the liquid can pass, is formed as a screen or filter which is mounted in a releasable manner, so that it is interchangeable. It can for example consist of a perforated sheet-metal tube, a cylindrical wire screen or a body having a suitable porosity e.g. a porous body consisting of a plastics material, a ceramic material, a sintered metal, cellulose, or textile fibres, and, where necessary, it can be stiffened and supported by metallic inserts or attachments. Instead of using a one-piece screen or filter, it is possible to employ a screen or filter which is composed of a number of shell-like or annular parts. The filter can be formed with ducts for a fluid medium serving to heat or cleanse the filter. Steam, compressed air, or water under pressure, can be used as the fluid medium. The use of steam has the advantage that it is possible, simultaneously with a cleansing and flushing operation, also to obtain approximately a required heating of the filter and thus of the mixture.

In order that the invention may be clearly understood, and readily carried into effect, reference will now be made, by way of example, to the accompanying drawing, wherein:—

Figures 1 and 1*a* show respectively axial and radial sections through a pumping and separating apparatus including an eccentric screw pump,

Figures 2 and 2*a* show corresponding sections through a modified version of the apparatus,

Figures 3 and 3*a* show corresponding sections through another modified version of the apparatus, and

Figures 4 and 4*a* show corresponding sections through yet another modified version of the apparatus.

Referring to the drawing, in all versions 1 indicates a rotor and 2 a stator of an eccentric screw pump. The rotor is driven through a Cardan shaft 3 from an input stub shaft 4. In the versions of Figures 1, 2 and 3, at the pressure side, the rotor 1 is coupled by way of a double universal joint 5 to a discharge screw 6 (36 in Figure 3) which rotates therewith. In Figure 1, the screw 6 is arranged in a pressure chamber 7, which has an axial outlet 8 and a peripheral wall 9 which is formed at least in part as a filter. This wall is encircled by a chamber 11 provided with a liquid outlet union 10 and serving to receive the liquid. In Figures 1, 2 and 4, there is arranged on the outlet 8 an adjustable valve 12 with a flexible tube 12′ and a valve adjustment member 12″ for adjusting the back pressure.

In the version shown in Figure 1, the wall 9 is a hollow cylindrical porous element, which rests in a cylindrical screen 13 by which it is closely encircled. The pump 1, 2 has an inlet union 14 for the solid-liquid mixture from which the liquid is to be separated, and the chamber 11 has a vacuum connection 33 for assisting the separating operation.

In the version shown in Figures 2 and 2*a*, bores 20 extend through the cylindrical filter 19, and these bores are inter-connected at one end of the filter 19 by an annular distributing chamber 21. Heating chambers 22 and 23 are also provided for the filter, 24, 25 and 26 being inlet unions and 27 and 28 being outlet unions for a cleaning and/or heating fluid. In this version, a relatively large collecting container 30 is connected to the liquid outlet union 10, the container having a liquid outlet pipe 31 extending almost to the bottom thereof, a liquid discharge union 32 and a duct 33 to which can be connected a vacuum source. Here again, the liquid separation is assisted by the vacuum, which produces suction in the interior of the chamber 11.

Figures 3 and 3*a* show a version in which the peripheral wall 39 of the pressure chamber and the discharge screw 36 for forwarding the solids to the outlet 8 are conically tapered towards the outlet. The result achieved is that the pressure of the mixture progressing towards the outlet 8 gradually increases.

In the version shown in Figures 4 and 4*a*, the discharge screw 46 is rigidly connected to the rotor 1, so that, in addition to participating in the rotational movement, it also participates in the oscillating movement of the rotor and simultaneously stirs and advances the mixture in the pressure chamber. Especially with this version, it may be advantageous for a stripper 40 (see also Figure 3) revolving with the discharge screw and sweeping over and cleaning the screen-like or filter-like portion of the wall to be arranged in the pressure chamber encircled by the wall 39. In the version according to Figure 4, this stripper 40 consists of revolving blades which are connected to the shaft 41 of the screw 46 by resilient members 42. The result obtained is that the stripper blades are always pressed resiliently against the wall 39 during the rotational movement. For the purpose of clarity, the stripper 40 is not shown in Figure 4*a*.

WHAT I CLAIM IS:—

1. A pumping and separating apparatus, comprising an eccentric screw pump for pumping a liquid-solid mixture, a chamber arranged at the pressure side of said pump and having an outlet for solids which is disposed on the axis of said pump at an end of said chamber remote from said pump and also having a tubular wall encircling said axis through at least a part of which wall liquid can pass such that said wall serves to separate liquid out of said mixture, and a discharge screw arranged within said chamber and coupled to the screw of said pump for forwarding solids of said mixture towards said outlet.

2. An apparatus as claimed in claim 1, wherein said wall is encircled by another chamber which has an outlet for liquid and which serves to receive the liquid passed through said wall.

3. An apparatus as claimed in claim 1 or 2, wherein a valve for adjusting back pressure is arranged at said outlet for solids.

4. An apparatus as claimed in any preceding claim, wherein said wall comprises a filtering wall in which extend ducts for a heating and/or cleansing medium for the filtering wall.

5. An apparatus as claimed in claim 2, or claim 3 or 4 as appended to claim 2, wherein said other chamber is provided with duct means for connection to a vacuum source.

6. An apparatus as claimed in any preceding claim, wherein said tubular wall and said discharge screw taper conically towards said outlet for solids.

7. An apparatus as claimed in any preceding claim, wherein said discharge screw is co-axial with said pump and with said chamber and is connected to the screw of the pump by a connecting device which acts in the manner of a double universal joint.

8. An apparatus as claimed in any one of claims 1 to 6, wherein said discharge screw is rigidly fixed to the screw of the pump.

9. An apparatus as claimed in any preced-

ing claim, wherein a stripper is arranged to revolve with said discharge screw and to sweep over at least a portion of said part of said wall at the inside.

10. A pumping and separating apparatus, substantially as hereinbefore described with reference to Figures 1 and 1*a*, Figures 2 and 2*a*, Figures 3 and 3*a*, or Figures 4 and 4*a*, of the accompanying drawing.

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1 SHEET

COMPLETE SPECIFICATION

This drawing is a reproduction of the Original on a reduced scale.

Fig. 1

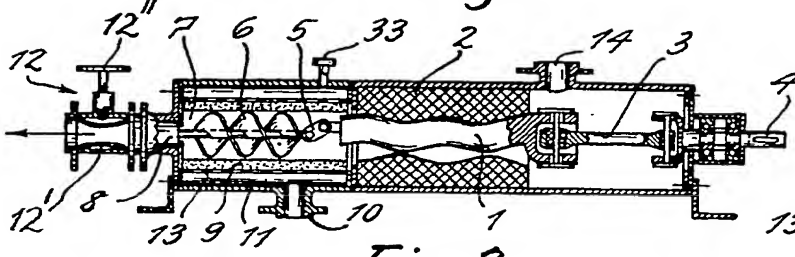

Fig. 1a

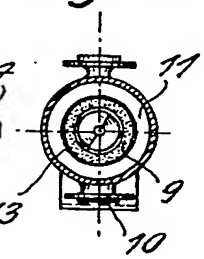

Fig. 2

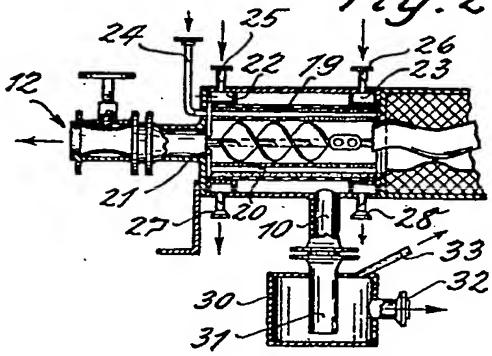

Fig. 2a

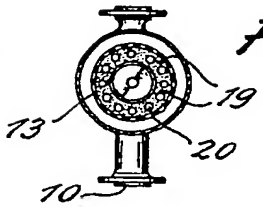

Fig. 3

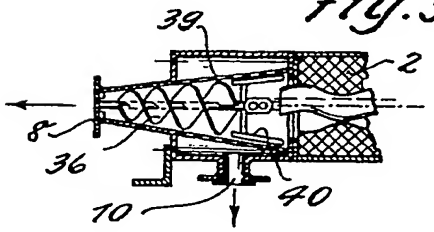

Fig. 3a

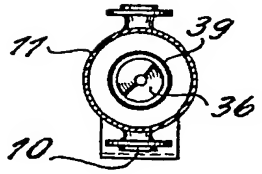

Fig. 4

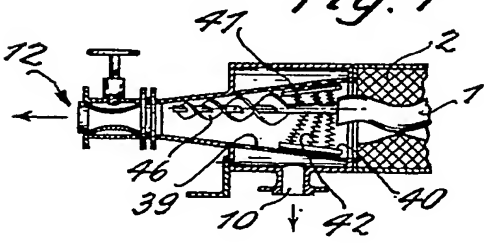

Fig. 4a